GKC Data and Model

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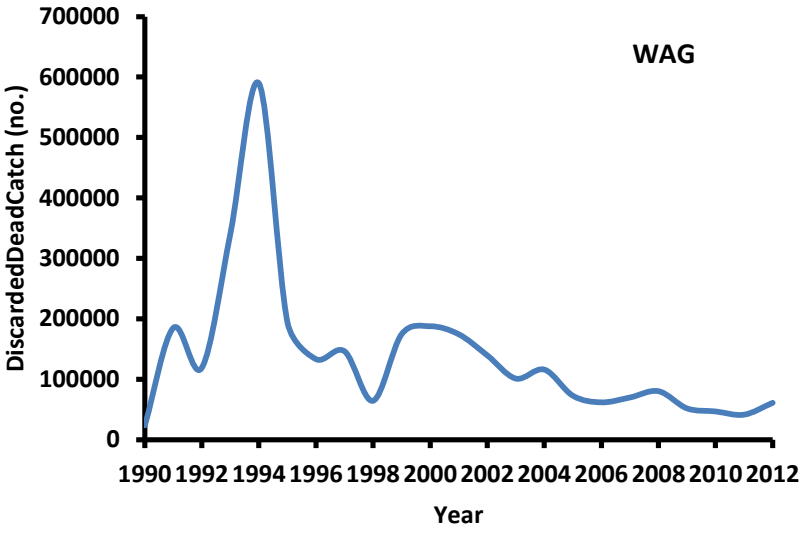
GKC Input Data and Likelihood

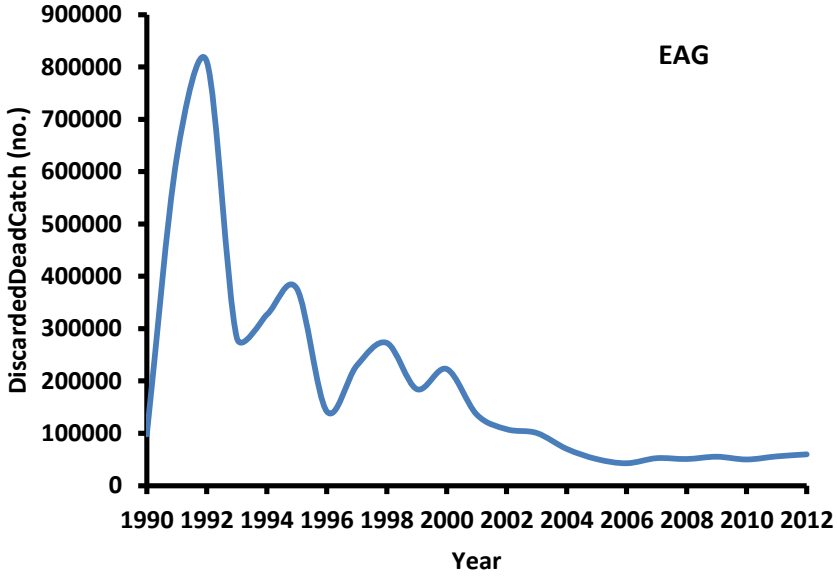
Data	EAG	WAG	Remarks
Annual Retained Catch (no)	1985/86-2012/13	1985/86-2012/13	**Likelihood function for annual total retained catch (1985/86-2012/13)**
Retained Catch Length Frequency (dockside sampling)	1985/86-2012/13	1985/86-2012/13	1.From the dockside sample weighted (by sampled boat landing) retained catch relative length frequency distribution is estimated for each year. 2. It is used to distribute the total retained catch into different size bins: 103, 108,…..183 mm CL
			Robust likelihood function for retained length composition (1985/86-2012/13)

GKC Input Data and Likelihood- continued…

Data	EAG	WAG	Remarks
Discard Catch (method 1)	1995/96-2012/13	1995/96-2012/13	1.From the observer length sample weighted (by sampled boat landing) total relative length frequency distribution is calculated for each year. 2. Sublegal nominal CPUE and legal not retained nominal CPUE are distributed among the length bins using the relative length frequencies in each subset. 3. CPUE in each length bin is multiplied by the annual total effort (number of potlifts) and a handling mortality (0.2) to obtain the discard catch by size. 4. Then the discard catches by size are summed up for the size range 100-185 mm CL (model size range) to get the annual discard death.
			Likelihood function for annual total discard catch.
			Robust likelihood function for discard length composition (1995/96-2012/13)

Directed GKC Fishery Bycatch





GKC Input Data and Likelihood- continued…

Data	EAG	WAG	Remarks
Discard Catch (method 2)	1990/91-2012/13	1990/91-2012/13	1.From the observer length sample weighted (by sampled boat landing) total relative length frequency distribution is calculated for each year. 2. Nominal total CPUE is multiplied by the annual total effort (number of potlifts) and the proportion of total catch above 100 mm CL are determined. From this the annual retained catch is deducted, and then multiplied the difference by the handling mortality to get the total discard death.
			Likelihood function for annual total discard catch.
			Robust likelihood function for total length composition (1990/91-2012/13)

GKC Input Data and Likelihood- continued…

Data	EAG	WAG	Remarks
Groudfish Discard Catch (method 2)	1995/96-2012/13	1995/96-2012/13	Groundfish Observer length frequency data and bycatch estimates for area 541 (EAG) and areas (542&543) are used to obtain male bycatch by size (100-185 mm CL).
			Likelihood function for annual total groundfish discard catch.
			Robust likelihood function for groundfish discard length composition (1995/96-2012/13)

GKC Input Data and Likelihood- continued…

Data	EAG	WAG	Remarks
Standardized CPUE index	1995/96-2012/13	1995/96-2012/13	GLM is fitted to determine CPUE index separately for 1995/96-2004/05 and 2005/06-2012/13 data sets. The index is related to abundance as: $CPUEIndex = q_t N_t^{\beta}$ Two scenarios are considered: 1. $\beta = 1$ for both periods. 2. β is estimated in the model (to address the hyper stability situation during the post crab rationalization period)
			Likelihood function for annual legal CPUE index (two separate LH components (1995/96-2004/05 and 2005/06-2012/13) are added up

GKC Input Data and Likelihood- continued…

Data	EAG	WAG	Remarks
Tag release-recapture size	1997,2000,2003,2006	Same tagging data are incorporated in the WAG data set	1.Tag release and recapture lengths grouped by year at large are used for a fixed growth matrix determination. 2. The proportion of recapture in length-class i of males that were released in a year t and length-class j when they were released and captured after year y is calculated using the growth matrix and summed up for length and year to get the multinomial proportion for the likelihood calculation.
			Likelihood function consists of six separate growth matrix related likelihood of recaptures for six years of observed recoveries.

GKC Input Data and Likelihood- continued…

Data	EAG	WAG	Remarks
Likelihoods not related to observed data			**1. Recruit_deviation likelihood 1986-2013** **2. Directed fishery F_deviation likelihood 1985-2012** **3. Groudfish bycatch F_deviation likelihood 1995-2012** **4. High grading QQ_deviation likelihood 1985-2012**
Other input information			1. Weight-at-length: $W = al^b$ where a= 2.988*10-4, b = 3.135. 2. M assumed to be 0.18 per year 3. Annual effective sample sizes (retained, directed fishery discard, groundfish discard) scaled to 200 4. Knife-edge male maturity length 121 mm CL

Observer Sample Legal Crab CPUE Index EAG

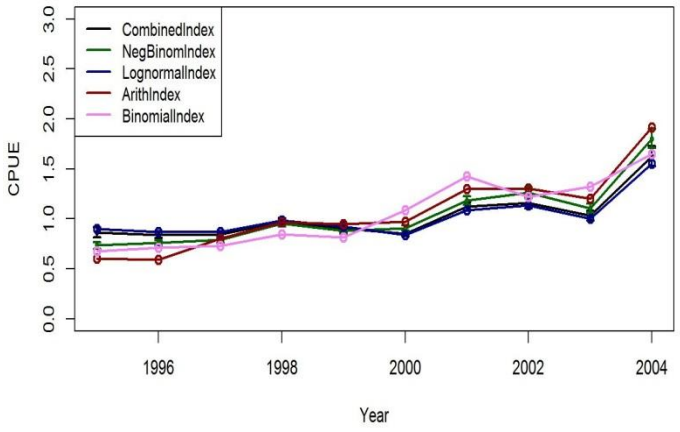
Year	Index	SE	Upper	Lower	
1995	0.734078	0.022352	0.767639		0.701985
1996	0.757845	0.01675	0.783663		0.732878
1997	0.79072	0.019055	0.821436		0.761152
1998	0.95423	0.017502	0.988224		0.921406
1999	0.883739	0.017378	0.914995		0.853552
2000	0.906559	0.015495	0.935093		0.878896
2001	1.184166	0.018037	1.227664		1.14221
2002	1.260583	0.021489	1.315942		1.207554
2003	1.105395	0.020627	1.15195		1.060721
2004	1.802102	0.027079	1.902391		1.707101
2005	1.109376	0.026829	1.170528		1.051419
2006	0.884354	0.024765	0.92926		0.841619
2007	1.019276	0.023594	1.068527		0.972295
2008	0.991436	0.026234	1.044844		0.940758
2009	0.829184	0.032557	0.884972		0.776912
2010	0.848939	0.030606	0.902528		0.798533
2011	1.22257	0.033152	1.30638		1.144137
2012	1.172026	0.030213	1.24503		1.103302

Observer Sample Legal Crab CPUE Index, WAG

Year	Index	SE	Upper	Lower
1995	1.174361	0.031266	1.25014	1.103175
1996	0.952084	0.02116	0.993241	0.912632
1997	0.961901	0.02233	1.005833	0.919887
1998	1.07029	0.027675	1.1312	1.01266
1999	0.909015	0.022015	0.949934	0.86986
2000	0.853381	0.020565	0.889213	0.818993
2001	0.8266	0.022521	0.864683	0.790195
2002	0.924268	0.024168	0.97004	0.880656
2003	1.157373	0.023727	1.213618	1.103734
2004	1.266515	0.023758	1.328148	1.207743
2005	1.035438	0.028075	1.09524	0.978901
2006	0.969583	0.030347	1.030254	0.912486
2007	0.884425	0.035113	0.948768	0.824446
2008	1.04512	0.027361	1.103906	0.989465
2009	1.058794	0.02891	1.121819	0.99931
2010	0.943499	0.029139	1.000118	0.890086
2011	1.013724	0.03068	1.077874	0.953392
2012	1.064119	0.030677	1.131452	1.000793

Figure 17. Trends in combined and negative binomial CPUE indices with two standard errors for EAG . Left figure: 1995/96–2004/05 observer data and right figure: 2005/06–2012/13 observer trimmed data. Arithmetic indices are shown on both plots for comparison. Combined indices: black line; Negative binomial indices: green line; Lognormal indices: blue line; Arithmetic indices: red line; and Binomial indices: purple line.

1995/96–2004/05 data



2005/06–2012/13 data

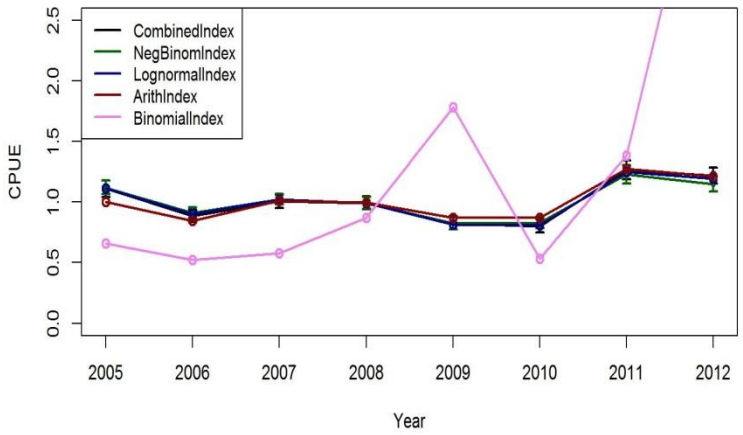
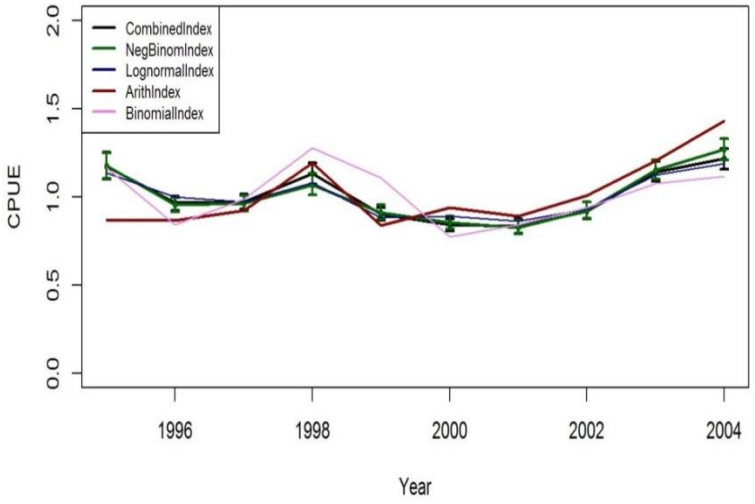
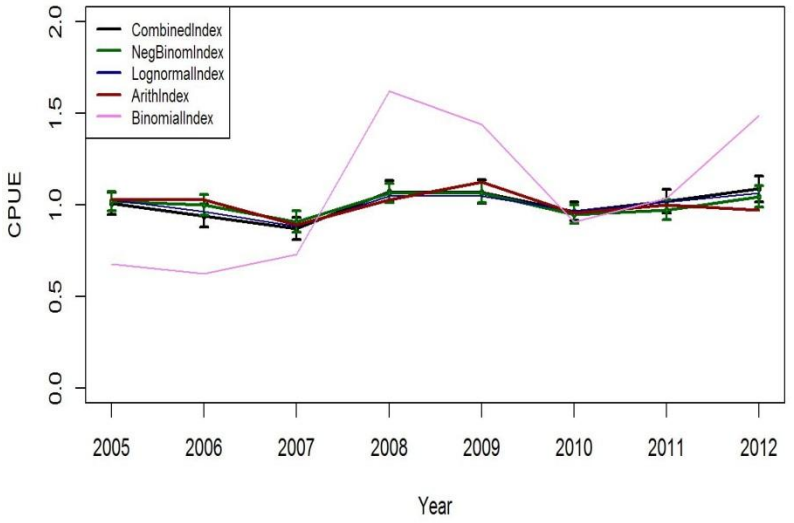


Figure 32. Trends in combined and negative binomial CPUE indices with two standard errors for WAG. Left figure: 1995/96–2004/05 observer data and right figure: 2005/06–2012/13 observer trimmed data. Arithmetic indices are shown on both plots for comparison. Combined indices: black line; Negative binomial indices: green line; Lognormal indices: blue line; Arithmetic indices: red line; and Binomial indices: purple line.

1995/96–2004/05 data



2005/06–2012/13 data



- Thanks!

Any suggestions/comments on

(a) Data organization

(b) Inclusion of CPUE hyperstability in the model?